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LASER TOOL APPARATUS

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ABSTRACT OF THE DISCLOSURE

This is a laser tool apparatus which comprises a movable shield and a plurality of cams and electric switches coupled to the shield and arranged to be operated in sequence as the shield is moved to specific predetermined locations relative to the laser beam and the operator's line of sight. To operate the device, the shield is rotated to a first position in the path of the laser beam to thereby shield the operator from dangerous light energy while allowing him to align the device. Thereafter, the operator must rotate the shield into a second position, blocking the operator's line of sight and shielding him from the laser beam before the laser energy can be activated.

Major problems are presented in transforming laser beam devices from laboratory curiosities into practical industrial tools. Of primary importance are the ever-present danger that the laser beam can blind one who is to use such a tool, and the danger of electric shock from the extremely high and dangerous voltages required to operate a laser.

It is an object of my invention to provide a unique laser tool for industrial purposes.

It is another object of my invention to provide a laser tool in which beam operation is prevented during positioning of a work piece to be subjected to the beam.

A further object of my invention is to provide laser apparatus which can be used without danger to the operator from either the beam or high voltages required for laser operation.

A still further object of my invention is to provide laser apparatus adapted for single-shot or repetitive beam operation.

It is also an object of my invention to provide a laser tool which is inherently reliable and safe.

The above and other objects and advantages of my invention will become apparent from the following description taken in conjunction with the accompanying drawings, in which:

FIGURE 1 is a perspective view of a laser tool showing a microscope attachment for focusing purposes, a laser housing to be raised and lowered in conjunction with focusing, a volt meter in the charging circuit for the laser light source, and an external control knob for operating a light shield and switches to effect single-shot laser operation;

FIGURE 2 is a fragmentary, longitudinal sectional view of the tool of FIGURE 1, showing the floor of the laser housing supported for effecting vertical movement of the housing, and showing the laser structure supported in the housing for directing the laser beam to a beam splitter in the microscope attachment;

FIGURE 3 is an end elevation view of the microscope attachment, partially broken away to show the eye shield and switch control cam operated by the external control knob;

FIGURE 4 is a side elevation view of the microscope attachment, partially broken away to show the shutter and beam splitter in section;

FIGURE 5 is a perspective view of the switch operating cams;

FIGURE 5a is a combination exploded and end elevation view of the cams;

FIGURE 6 is a schematic diagram of a circuit of my invention for controlling the charging and triggering of the laser, and showing the positions of cam operated switches to prevent charging while the operator is using the microscope for focusing purposes;

FIGURE 7 is a schematic diagram of the portion of the circuit of FIGURE 6 wherein the shorting switch for the capacitor bank is opened upon initiating movement of the external control knob to move the shield toward the laser firing position;

FIGURE 8 is a schematic diagram similar to FIGURE 7, showing the resettable switch of the charging circuit closed during continued movement of the shield toward the laser firing position;

FIGURE 9 is a schematic diagram of the portion of the circuit illustrated in FIGURES 7 and 8, showing the second switch of the charging circuit closed when the shield is in the laser firing position, and indicating the firing operation of the laser; and

FIGURE 10 is a schematic diagram of the portion of the circuit shown in FIGURES 7–9, showing the resettable switch in a charging circuit moved to the open position through the action of its relay immediately after the laser is triggered.

Referring to FIGURE 1, there is shown a base member **10** on the rear of which is mounted an elevator housing **11** having a front opening **12** into which one end of a laser support housing **13** extends. Referring to FIGURE 2 along with FIGURE 1, the laser support housing **13** is a hollow housing having a rigid floor member **14** which at its rear extends outwardly and rearwardly from the housing **13**. Vertical rods **15**, **16**, preferably three in number, extend through rearwardly and outwardly extending portions of the floor **14**.

It will be seen that rods **16** are located in the side portions of the elevator housing **11**, and the rod **15** is located in the center of the elevator housing and behind the laser housing **13**. The rods **16** have smooth surfaces, and extend through bearing boxes **17** mounted on the side extensions of the floor **14**. The other rod **15** is threaded, and is journaled at its ends for rotation in the top of the housing **11** and the base member **10**. The opening of the floor **14** through which the threaded rod **15** extends is internally threaded so that, upon rotation of the rod **15**, the floor **14**, and hence the housing **13**, can be raised and lowered as desired. To this end, an external crank **18** mounted on the top of the base member **10** is adapted to rotate the rod **15** as desired, as through suitable linkage (not shown) located within the base member **10**. One example of a linkage for this purpose is shown in my co-pending application, "System For Focusing Laser Energy," Ser. No. 505,807, filed concurrently herewith.

As shown in FIGURE 1, the front portion of the base member **10** is provided with a depression or well **20** to recevie a work piece that is to be treated with a laser beam. The forward end of the laser housing **13** extends over the well **20**, and carries a microscope attachment **21** through which to view a work piece placed in the well **20**. While the microscope attachment **21** is shown as having binocular eye-pieces, it will be apparent that a single eye-piece may be employed.

Again referring to FIGURE 2, the microscope attachment **21** carries a beam splitting reflecting mirror **22** which is disposed in the path **23** of the beam that emerges horizontally from a laser device **24**, and deflects the beam vertically downward, as indicated at **23'**, to impinge upon the work piece in the well **20**.